October, 1880, by M. Renevier.—Meteorological *résumé* of the year 1880 for Geneva and Great St. Bernard, by M. Plantamour.—Periodical movements of the ground indicated by the air-bubble of spirit-levels, by the same.—On the movements of the ground, by Col. von Orff.

Reale Istituto Lombardo di Scienze e Lettere. Rendiconti, vol. xiv., fasc. xvii.—On recent discoveries of Silurian fossils in the province of Udine, by M. E. T. Taramelli.—Synthesis of β methylpyridine (β picoline), by G. Zanoni.

SOCIETIES AND ACADEMIES

LONDON

Royal Society, December 15, 1881.—"On the Electromotive Properties of the Leaf of Dioneæ in the Excited and Unexcited States." By J. Burdon Sanderson, M.D., F.R.S., &c. (Abstract.)

The paper consists of five parts. Part I. is occupied by the examination of two experimental researches, relating to the subject, which have been published in Germany since the date of the author's first communication to the Royal Society, namely, that of Prof. Munk on Dionæa, and of Dr. Kunkel on electromotive action in the living organs of plants. According to Dr. Munk, the electric properties of the leaf may be explained on the theory that each cylindrical cell of its parenchyma is an electromotor, of which the middle is, in the unexcited state, negative to the ends, and that on excitation the electromotive forces of the cells of the upper layer undergo diminution, those of the lower layer an increase. He accounts for the diphasic character of the electrical disturbance which follows mechanical excitation by attributing it to the opposite electromotive reactions of the two layers of cells. According to this theory, each cell resembles in its properties the muscle-cylinder ("Untersuchungen," vol. i. p. 682, 1848) of du Bois-Reymond, differing from it in so far that its poles are positive instead of being negative to its equatorial zone.

Dr. Kunkel's experiments have for their purpose to show that all the electromotive phenomena of plants may be explained as consequences of the movement of water in the organs at the surfaces of which they manifest themselves. Neither of these theories is consistent with the author's observations.

Part II. contains a description of the apparatus and methods used in the present investigation.

In Part III. are given the experimental results relating to the electromotive properties of the leaf in the unexcited state, a subject of which the discussion was deferred in the paper communicated by the author (with Mr. Page) in 1876.[1] The fundamental fact relating to the distribution of electrical tension on the surface of the leaf when in the unexcited state is found to be that (whatever may be the previous electrical relation between the two surfaces) the upper surface becomes, after one or two excitations, negative to the under, and remains so for some time. Under the conditions stated, this difference of potential between the two surfaces occurs constantly; the differences of potential which present themselves when other points of the surface of the leaf are compared, may be explained as derived from, or dependent on, it.

Part IV. relates to the immediate electrical results of excitation, *i.e.* to the electrical phenomena of the excitatory process. In investigating these the author takes, as the point of departure, an experiment which includes and serves to explain those obtained by other methods, and is therefore termed the "fundamental experiment." It consists in measuring the successive differences of potential which present themselves between two opposite points on the upper and on the under surface of one lobe of the leaf, during periods which precede, include, and follow the moment at which the opposite lobe is mechanically or electrically excited. In this experiment it is found that, provided that the conditions are favourable to the vigour of the leaf, the changes in the electrical relations of the two surfaces (called the excitatory variation) occur in the following order:—

Before excitation (particularly if the leaf has been previously excited).	*Upper* surface negative to under.
At the moment of excitation.	Sudden negativity of *under* surface, attaining its maximum in about half a second, the difference amounting to not less than $\frac{1}{15}$ Daniell.
After excitation.	Rapidly increasing negativity of the *upper* surface, beginning 1·5″, and culminating about 3″ after excitation, and slowly subsiding.

[1] "On the Mechanical Effects and on the Electrical Disturbance consequent on Excitation, &c.," *Proceedings*, December 14, 1876.

This subsidence is not complete, for, as has been said, the lasting difference between the two surfaces is augmented—the upper surface becoming more negative after each excitation ("after-effect").

When by a similar method two points are taken for comparison on opposite lobes, the phenomena are more complicated, but admit of being explained as resulting from the more simple case above stated, in which only a few strata of cells are interposed between the leading off electrodes.

In Part V. the relation of the leaf to different modes of excitation is investigated. As regards electrical excitation the results are as follows:—If a voltaic current is led across one lobe by non-polarisable electrodes applied to opposite surfaces (the other lobe being led off as in the fundamental experiment) a response (excitatory variation) occurs at the moment that the current is closed, provided that the strength of the current is adequate, and not much more than adequate. No response occurs at breaking the current. When a current of more than adequate strength is used, and its direction is downwards, the response at closing is followed by several others. This effect does not happen when the current is directed upwards. To evoke a response a current must be much stronger if directed upwards than if directed downwards through the same electrodes. Weak currents cease to act when their duration is reduced to $\frac{1}{100}$″; for stronger ones the limit is shorter. Inadequate currents, if directed downwards, produce negativity of the upper surface, which lasts for several seconds after the current is broken. This effect is limited to the surfaces through which the current is led. Its direction shows it is not dependent on polarisation. By opening induction-currents, if their strength does not much exceed the limit of adequacy, a leaf may be excited at intervals for several hours without failure. Weaker currents are more effectual when directed downwards than when directed upwards. If two inadequate induction-currents follow one another at any interval less than 0″·4 and greater than 0″·02, they may evoke a response. In this case a response follows the second excitation. When a leaf is subjected to a series of induction currents at short intervals ($\frac{1}{30}$″) the response occurs after a greater or less number of excitations. If the temperature is gradually diminished the number is increased by each diminution. All of the above statements relating to excitability refer to plants kept in a moist atmosphere at 32—35° C.

From the preceding facts and others which are stated in the paper, the author infers (1) that the difference observed between different parts of the surface of the leaf are the expressions of electromotive forces which have their seat in the living protoplasm of the parenchyma cells. (2) That the second phase of the excitatory variation is probably dependent on the diminution of turgor of the excited cells, and therefore on the migration of liquid; (3) but that no such explanation can possibly be accepted of the phenomena of the first phase, the time relations of which, particularly its sudden accession and rapid propagation, show it to be the analogue of the "negative variation" or "action current" of animal physiology.

Zoological Society, January 3.—Prof. W. H. Flower, F.R.S., president, in the chair.—Mr. W. A. Forbes exhibited and made remarks on the horns of the Prong Buck (*Antilocapra americana*) lately shed by the specimen living in the Society's Gardens. This was, it is believed, the first instance on record of the same individual having shed its horns in captivity in two consecutive years.—A communication was read from Prof. Owen, C.B., on *Dinornis* (Part xxiii.), containing a description of *Dinornis parvus*, a new species of about the size of the Dodo, of which a very complete skeleton (now in the British Museum) had been lately discovered in a cavern in the province of Nelson, New Zealand.—A communication was read from M. L. Taczanowski, C.M.Z.S., containing an account of the birds collected by Mr. Stolzmann during his recent journey in North-Eastern Peru, with descriptions of some new species.—A communication was read from Mr. Martin Jacoby, containing the descriptions of three new genera and fourteen new species of Phytophagous Coleoptera from various localities.—Mr. Oldfield Thomas read a paper on the African Mungooses (*Herpestinæ*), in which he reduced the described species of this group to nineteen, divisible into seven genera.—The Rev. Canon Tristram read the descrip-

tion of a new species of Land-rail obtained at Ribè, East Africa, by Mr. R. C. Ramshaw, which was proposed to be named *Crex suahilensis*.—Mr. W. A. Forbes read a paper on the existence of a gall-bladder in, and on other points in the anatomy of, the Barbets and Toucans (*Capitonidæ*). The peculiar form of the gall-bladder in these birds, as well as other features in their myology now described for the first time, were stated to make the relationship of this group to the Woodpeckers (*Picidæ*) still more certain than it had previously been from the observations of Nitzsch, Kessler, Garrod, and others.

Meteorological Society, December 21, 1881.—Mr. G. J. Symons, F.R.S., President, in the chair.—The following were elected Fellows of the Society:—H. P. Bell, F. B. Edmonds, T. C. Evans, S. L. Fox, J. J. Gilbert, M. Henry, J. B. McCallum, J. Parry, and B. C. Wainwright.—The papers read were—The rainfall of Cherrapunji, by Prof. J. Eliot, M.A., F.M.S. Cherrapunji is notorious for its excessive rainfall, larger in amount it is believed, that any at other place, so far as is known. Cherrapunji is a small Indian station situated in the south-west of Assam, on a small plateau forming the summit of one of the spurs of the Khasia Hills. These hills rise on the south with exceeding abruptness, and have the Bengal plains and lowlands at their base. Cherrapunji stands on the summit of one of these hills, at an elevation of about 4100 feet. The hill on which it is situated rises precipitously from the lowlands of Cachar and Sylhet, which are barely 100 feet above sea-level. During the south-west monsoon the lower atmospheric current advancing across the coast of Bengal has a direction varying between south-south-west and south-east in Lower and Central Bengal. In thus advancing almost directly towards the hills of Western Assam, the mountain ranges cause a very considerable deflection of the current; one portion is forced upwards as an ascending current with a velocity directly dependent upon the strength of the current in the rear, and upon other conditions which need not be enumerated. The rapid diminution of temperature which accompanies expansion due to ascensional movement of air is usually followed by rapid condensation in the case of a moist current, such as the south-west monsoon current. The normal annual rainfall in Cachar and in the plains of Northern Bengal is about 100 inches. The average annual rainfall of Cherrapunji is 493 inches, that is, 393 inches in excess of that at the foot of the hills on which it is situated. The rainfall of Cherrapunji is not due to any abnormal local conditions of atmospheric pressure, air movement, &c., but simply and solely owing to the presence of a vast mechanical obstruction which converts horizontal air motion into vertical air motion.—On the meteorology of Cannes, France, by Dr. W. Marcet, F.R.S., F.M.S.. This is a discussion of the observations made at this celebrated health-resort during the six winter seasons ending 1880.—Report on the phenological observations, 1881, by the Rev. T. A. Preston, M.A., F.M.S.

Royal Microscopical Sociey, December 14, 1881.—Prof. P. Martin Duncan, F.R.S., president, in the chair.—Eight new Fellows were elected and nominated.—Mr. J. Deby exhibited his method of turning the correction-collar of objectives by a worm-wheel, acted upon by a tangent screw with a long arm, and Mr. Crisp exhibited Parkes' drawing-room microscope and two new homogeneous immersion fluids from Dr. van Heurck of Antwerp.—Mr. T. Charters White described a new growing slide devised by him, and Mr. Stephenson exhibited scales of *Machilis maritimus* and *Tomocerus plumbeus*, mounted in phosphorus under the binocular, with 1-25 inch objective, showing that the scales were plane on the under side and corrugated on the upper, a view which Mr. J. Beck controverted.—A note was read by Dr. Anthony on the statoblast of *Lophopus crystallinus* as a test for high powers.—Mr. Guimaraens exhibited the Echinorhynchus of *Lota vulgaris*, suggested to be a male specimen containing ova described as "dedans par hasard."—Mr. A. D. Michael read a paper, further notes on British *Oribatidæ*, which Prof. Huxley and others state to be wholly viviparous. He finds, however, that they are chiefly oviparous, as stated by Nicolet and others, and that the young are brought to maturity in at least four different modes; (1) the egg is deposited in a slightly advanced stage, as in insects; (2) deposited with the larva almost fully formed; (3) the female is occasionally viviparous (in these modes only one egg is usually ripe at a time); (4) several eggs are matured at once, but not deposited. The mother dies, the contents of her body, except the eggs, dry up, and her chitinous exterior skeleton forms a protection throughout the winter to the eggs. The occurrence of a deutovium stage in the egg is recorded, *i.e.* the egg has a hard shell, which splits into two halves as the contents increase in volume, the lining membrane showing between, and gradually becoming the true exterior envelope of the egg.—Several new and interesting species were described and figured, and exhibited under microscopes, Mr. W. H. Symons also read a paper on a hot or cold stage for the microscope.

Geological Society, December 21, 1881.—Mr. R. Etheridge, F.R.S. president, in the chair.—Messrs. Charles Duffin Barstow and Joseph Lundy were elected Fellows, and Prof. E. D. Cope, of Philadelphia, a Foreign Correspondent of the Society.—The following communications were read:—The Torridon Sandstone in relation to the Ordovician rocks of the Northern Highlands, by Mr. C. Callaway, M.A., D.Sc., F.G.S. —The Precambian (Archæan) rocks of Shropshire, part 2, by Mr. C. Callaway, D.Sc., F.G.S.—The red sands of the Arabian Desert, by Mr. J. A. Phillips, F.R.S., F.G.S. The author described the general characters of the Nefüd, of great red desert of Northern Arabia, which consists of a series of parallel ridges of considerable elevation, no doubt at some period piled up by the action of strong winds, but now no longer undergoing much change of position, as is evidenced by the fact that sticks and stones remain for many days uncovered on the surface, and that the landmarks made use of in crossing the desert appear to be permanent. A specimen of the sand of this desert received by the author from Lady Anne Blunt, is composed of well-rounded red grains from 1-50th to 1-30th of an inch in their longest diameter, which are rendered colourless by treatment with hydrochloric acid, the material thus removed amounting to ·21 per cent., or a little more than 1-500th of the total weight operated upon, and consisting of ferric oxide with a small quantity of alumina. The sand dried after the action of hydrochloric acid gave on analysis:—

Silica	98·53
Protoxide of iron	0·28
Alumina	0·88
Lime, magnesia, and alkalies	trace
	99·69

The external coating of ferric oxide must therefore have been deposited subsequently to the rounding of the grains; it could not have been derived from an external decomposition of the grains themselves; and it becomes difficult to imagine in what manner the superficial red coating can have been produced. The author compared these grains with those of the millet-seed sandstones of Triassic age, with which they closely agree in character, but remarked that the conditions of their occurrence were apparently quite different.—Analyses of five rocks from the Charnwood Forest district, by Mr. E. E. Berry, communicated, with notes, by Prof. T. G. Bonney, F.G.S., Sec. G.S.

EDINBURGH

Royal Society, December 19, 1881.—Mr. D. Milne Home, vice-president, in the chair.—The Makdougall Brisbane prize fur the period 1878–80 was presented to Prof. Piazzi Smyth, Astronomer-Royal for Scotland, for his extremely valuable paper on "The Solar Spectrum in 1877-78."—Sir Robert Christison communicated a short paper on the application of the rocks of the great precipice of Ben Nevis to ornamental work, in which he drew attention to the little-known but most magnificent view of the great precipice from below, characterising it as the grandest in the whole island. From the various kinds of granitic and porphyritic rocks there found, all of which are susceptible of a high polish, he had got constructed a very graceful obelisk, which was shown to the Society.—Dr. D. J. Hamilton exhibited and described certain physical experiments bearing on the circulation of the blood-corpuscles, from which he explained many points hitherto unexplained. Thus the rapid gliding central motion of the coloured corpuscles, and the slower rotational peripheral motion of the colourless corpuscles were to be explained by the fact that the latter were specifically lighter than the blood plasma, while the former were of the same specific gravity as the fluid in which they were borne along. Such a physical difference was sufficient to explain the phenomenon; and that such a difference existed could easily be demonstrated by observation as to the parts of a blood-vessel in which the colourless corpuscles abound. The second part of the paper dealt with more purely pathological questions, referring, for example, the migration of the blood corpuscles from the blood-

vessels into the surrounding tissues simply to the increase of fluid pressure caused by stasis, and not to the amœboid movements of the corpuscles, which are generally urged as the true cause. Dr. R. S. Marsden read a paper on the state of carbon in iron and steel, in which it was argued that the molten metal held the carbon in solution, and that, on cooling, the carbon crystallised out in minute diamond crystals, so giving to the metal its peculiar hardness and temper. Much would depend on the size and number of the crystals, and the size was obviously a function of the rate of cooling; so it was quite conceivable that too much, as well as too little, carbon might have a deleterious effect upon the physical properties of the metal.

Boston, U.S.A.

American Academy of Arts and Sciences, December 14, 1881.—Prof. J. Lovering, president, in the chair.—Prof. C. L. Jackson and Mr. A. E. Menke presented the results of an investigation upon curcumin. The formula was shown to be $C_{14}H_{14}O_4$. By the study of the potassium salts it was proved to be a diatomic monobasic acid. Powerful oxidising agents destroy it; weaker agents, not in excess, give vanillin, but in too small quantity for purification; by oxidising diethylcurcumin, however, with potassic permanganate the authors obtained ethylvanillic acid, with melting-point at 195°.—A paper on a comparison of the Harvard College Observatory Catalogue of Stars for 1875, with the fundamental systems of Auwers, Boss, Safford, and Newcomb, was read by Prof. William A. Rogers.—Dr. Wolcott Gibbs announced the discovery of the following new complex acids:—Arsenoso-molybdic acid, arsenoso-tungstic acid, antimonoso-molybdic acid, antimonoso-tungstic acid, vanadoso-molybdic acid, vanadoso-tungstic acid, vanadio-phosphoric acid, vanadio-arsenic acid, vanadio-antimonic acid. All of these acids have well-defined series of salts.—A paper on the law of diffusion of gases was read by Mr. N. D. C. Hodges.

Paris

Academy of Sciences, January 2.—M. Jamin in the chair.—M. Blanchard was elected Vice-President for 1882.—The Academy has lost three members during 1881, viz. MM. Delesse, Deville, and Bouillaud; and two correspondents, MM. Kuhlmann and Pierre.—M. Faye presented the *Annuaire du Bureau des Longitudes* for 1882; it contains, *inter alia*, a complete table, with history, &c., of the comets of the last decade, by M. Lœwy, and a fac-simile of M. Janssen's photograph of the comet of last summer.—On the correction of compasses, and on M. Collet's recent "Treatise on the Regulation and the Compensation of the Compass," by M. Faye.—Craniology of the Mongolian and white races, by MM. de Quatrefages and Hamy. They presented the tenth and last volume of their "Crania Ethnica," and gave a *résumé* of the contents. The different general forms of the human skull are found in each of the three chief races; but while among the black races, globular skulls, and among the yellow, elongated skulls, are rare, among the white the two cephalic types coexist in nearly equal proportions. The authors regard craniology as one of the most powerful means of scientific study of human races.—On the diffusion of solids, by M. Colson. To a given temperature corresponds a constant coefficient of diffusion of carbon in iron. This law holds only so long as the iron is transformed into steel. Among substances that diffuse very easily in carbon, silica holds the first place. Platinum wire, heated long enough with lampblack in an earthenware crucible, becomes crystalline, and has the composition $SiPt_2$ (the silicum being from the crucible, whose silica is diffused in the lampblack). Repeating the experiment with lampblack holding 60 per cent. of precipitated silica, one obtains SiS_2Pt_3.—On the diffusion of carbon, by M. Violle. He had observed, in 1878, a diffusion of carbon in porcelain (temperature under 1500°).—Anchylostoma (duodenal anchylostoma of Dubini) in France, and the disease of miners, by M. Perroncito. The miners' anæmia of Saint Etienne has the same parasitic cause as that of the workmen in the St. Gothard, the Schemnitz miners, &c. The malady may be prevented by cleanliness and treatment of excrementitious matters with heat of 50° C. (to kill eggs, larva, and worms), or better, with concentrated solutions of chloride of sodium, sulphuric, hydrochloric or carbolic acid, or Depernis's insecticide liquid. Patients should be treated with doses of etherised extract of male fern.—On algebraic forms with several series of variables, by M. le Paize.—Integration of certain equations with partial derivatives, by means of definite integrals containing, under the sign *s*, the product of two arbitrary functions, by M. Boussinesq.—On the theory of motion of planets, by M. de Casparis.—On the determination of the ohm; reply to M. Brillouin, by M. Lippmann.—Measurement of potentials corresponding to determinate explosive distances, by M. Baille. The potential of an electrified plane increases nearly regularly with the explosive distance which can be traversed. The electric densities decrease at first slowly, reaching a constant value about 0.5 ctm. The pressure of electricity on the air when a spark of 0·01 m. passes is only 1-2000th of atmospheric pressure.—Note on the temperatures of the sea observed during the mission to Lapland, by M. Pouchet. In the roadstead of Vadsö the mean sea-temperature rose about 9° in 50 days from June 8 (or about 0°·2 a day). A cooling influence of the coast was observed to $1\frac{1}{2}$ miles and to a depth of 100m. at the Vadsö anchorage (a difference of about 1° for depths of 20 to 30m.). The temperature always decreased very regularly to the bottom.—On the ratio of potash to soda in natural waters, by M. Clooëez. This relates to water of the Seine, Marne, Dhnis, Vanne, &c. In general the potash counts for more than 1-5th in the sum of alkalis (potash 25, soda 100), and while the potash comes from decomposition of felspathic rocks, the soda is probably from chloride of sodium impregnating all the strata, except granitic soils. The Vanne, rising in the chalk and not meeting argillaceous deposits, has no salts of potash.—On the complex function of morphine, its transformation into picric acid, and its solubility, by M. Chastaing.—On artificial production of the forms of organic elements, by MM. Monnier and Vogt. He obtains cells, tubes, &c., by bringing together two salts in a liquid, forming by double decomposition one or two insoluble salts.—Researches on development of cryptogamic vegetation without and within hens' eggs, by M. Dareste. Such vegetation he found on most of sixty eggs submitted singly to artificial incubation in a small vessel hermetically closed with a caoutchouc stopper. He considers the spores to have entered the oviduct from the cloaca and to have been incarcerated in the egg during its passage in the oviduct. The vegetation may be fatal to the embryo.—On a parasitic tuberculosis of the dog and on the pathogeny of tuberculous follicle, by M. Laulanié. He observed in a dog's lung alterations very like those of tuberculosis, produced by eggs of a nematoid (*Strongylus vasorum*, Baillet).

Vienna

Imperial Institute of Geology, December 6, 1881.—G. Laube, on melaphyry-stones inclosed in the porphyry of Liebenau (Bohemia).—R. Hoernes, on the remains of mammalia found in the brown coal at Goeriach, near Turnan, Styria.—Th. Fuchs, on the relations of heat and light of the ocean.—L. Szajnocha, exhibition of the geological map of Taslo and Krosmo in Western Gallicia.

December 20.—C. Doelter, on the volcanic rocks of the Cape Verde Islands.—R. Hoernes, exhibition of remains of mammalia from the Styrian brown coal-deposits.—G. Stache, new data on the occurrence of olivin-rocks on the gneiss mountains of Southern Tyrol.—V. Uhlig, on the composition of the lime-rocks at Lublau (Hungary).

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